

# **STAFF REPORT**

Amendments to

**Regulation 8**

**ORGANIC COMPOUNDS**

**Rule 5**

**STORAGE OF ORGANIC LIQUIDS**

**BAY AREA AIR QUALITY MANAGEMENT DISTRICT**

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**November 2, 1999**

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**REGULATION 8 RULE 5**  
**STORAGE OF ORGANIC LIQUIDS**

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## EXECUTIVE SUMMARY

This report provides background information on the rule development process for Regulation 8, Rule 5: Storage of Organic Liquids. The proposed amendments are intended to:

1. Implement before June 1, 2000, the control measure for slotted guide poles in accordance with the District's 1999 Ozone Attainment Plan for the one-hour federal ozone standard.
2. Modify the requirement for primary metallic-shoe type seals used in internal floating roof tanks containing organic liquids that produce ozone forming air pollutants.

The proposed revisions include both partially implement Control Measure B2 from the 1997 Clean Air Plan (CAP) and Control Measure SS-07 in the 1999 Ozone Attainment Plan. Based on EPA's redesignation of the Bay Area to non-attainment for the federal one-hour ozone standard, the District has committed to adopt these slotted guide pole requirements before December 31, 1999 and implement the standards before June 1, 2000 in order to meet the requirements of the July 10, 1998 Federal Register Notice (63 FR 37258).

Ozone forming emissions from organic storage tanks in the Bay Area are estimated to be 12.6 tons per day. This figure excluding gasoline station storage dispensing facilities, tank cleaning, roof landing and refloating of the roofs. The estimate of emission reductions for this control measure contained in the Ozone Attainment Plan was 0.49 ton/day of precursor organic compounds. As a result of emission inventory research in the District's Databank during the course of this rule development effort, a refined estimate of reductions from implementing the relevant amendments is 0.87 ton/day.

The cost-effectiveness of the proposed amendments is \$1250 per ton of VOC emission reduced. There are no significant socioeconomic impacts identified resulting from this proposal. Staff has not identified potential control option that could achieve the same emission reduction and has not been able to conduct an incremental cost effectiveness analysis for such option.

Based on an initial study performed for this project, staff have determined that there is no substantial evidence in light of the record before the District that for the proposed amendments to Regulation 8, Rule 5 would have a significant effect on the environment.

Staff is proposing to revise this rule in two phases; the first phase is to meet the immediate obligations of the 1999 Ozone Attainment Plan and the second phase is to investigate potentially significant areas of emission reductions from this source category.

On September 23, 1999, a public workshop was held to discuss both the present amendments and the proposed Phase II amendments. However, due District commitments in its Ozone Attainment Plan, and the fact that additional time is needed to workshop and develop proposed rule language for future reductions, staff has split the

proposal into the two phases described above. It is projected that the implementation of Phase II will further reduce organic emissions from organic liquid storage by at least 8 tons per day.

## **Background**

Regulation 8, Rule 5 limits organic emissions from liquid storage tanks. The rule was originally adopted in 1978 and has been amended a number of times, most recently in 1993. The rule affects mostly petroleum refineries, chemical plants and bulk gasoline terminal distribution facilities. Some other industries that store significant amount of organic liquids are also subject to the Rule.

Emissions controls on stationary tanks storing organic liquids significantly reduce organic emissions because of the large number of tanks in the Bay Area. Generally, tanks can be categorized by roof type and tank construction, as either fixed or cones roof tanks, external floating roof tanks, or internal floating roof tanks. There are approximately 5,200 permitted organic liquid tanks in the Bay Area. There are about 4,700 with fixed or cone roof tanks, 320 are external floating roof tanks and 200 are internal floating roof tanks.

Emissions from fixed roof tanks can be controlled in various ways, including vapor recovery or closed vent systems. Emissions from internal and external floating roof tanks are controlled by allowing little or no vapor head space above the organic liquid to become saturated with organic vapors and expelled as the tank is emptied and refilled. Both types of floating roof tanks have fugitive emissions from deck roof-fittings and rim seals between the floating roof and the tank shell.

In 1993, amendments to Regulation 8, Rule 5 were adopted by the Board of Directors that partially implemented Control Measure B2 of the District's 1991 Clean Air Plan that directed at the California one-hour ozone standard. Upon redesignation to non-attainment of the federal one-hour ozone standard by the US EPA of July 1998, the portion of control measure B2 required to be implemented by the District before June 1, 2000 and was designated as control measure SS-07 in the Ozone Attainment Plan. That portion dealt with controlling emissions from slotted guide poles.

## **Proposed Rule Amendments**

The proposed amendments to Regulation 8, Rule 5 are discussed in detail below.

### **Control Measure SS-07, Emissions from Slotted Guidepoles**

Estimated Emission Reductions:	0.87 ton/day of VOC emissions
Estimated cost of controls:	\$400,000 total cost to the industry
Cost effectiveness:	\$1250/ton of VOC emission reduced

Slotted guide poles are anti-rotational devices (guidepoles) that have slots or holes for gauging purposes. The slots or holes provide an opening that allows the operator to see the liquid surface and take samples. The openings also provide a path for vapors to escape the tank. Organic emissions from slotted guide poles are significant, especially when wind movements through the slots creates a pressure differential that draws vapors out of the tank. The proposed amendments require the use of gaskets, wipers, and pole sleeves to minimize evaporation.

Retrofit kits for slotted guidepoles are readily available which will significantly reduce emissions and can be installed without taking the tank out of service.

American Petroleum Institute's data suggests that the product loss savings will offset the cost of slotted guide pole modifications within 2 years. The March, 1994 API document states:

“ Not only is modifying [\*] the slotted guide pole economically feasible, it also results in greater emission reduction than replacement of an unmodified slotted guide pole with an unslotted guide pole.”

[\* ] According to the API report, modifications include addition of a sliding cover, well gasket, pole sleeve, pole wiper, and float and float wiper.

Staff estimated that the cost effectiveness to be about \$1250 per ton of VOC emission reduced for the proposed slotted guide pole modifications compared to \$23 per ton of VOC emission reduced reported by API. The staff cost effectiveness is based on \$2,000 per tank for additional components that would be required by the proposed changes. The API analysis uses a larger emission reduction (214.8 tons per year per tank) and a higher total cost of \$5,000 per tank resulting in a lower cost effectiveness.

### **Amendment to Metallic-shoe-type seals for existing internal floating roof tanks**

District staff has determined that a separate criteria is needed for internal and external floating roofs for the minimum distance required to extend below the liquid surface for a metallic shoe type seal. The New Source Performance Standard (NSPS) for organic liquid storage in external floating roof tanks require that the seal extend a minimum vertical distance of 24 inches above the liquid surface. Unlike an external floating roof tank where the roof is exposed to the atmosphere, the primary seal on an internal floating roof tank, wind is not a significant parameter in creating fugitive emissions, so changing the distance requirement for internal floating roofs will not affect emissions.

#### *8-5-111 Limited Exemption, Tank Removal from and Return to Service*

The purpose of this section is to allow tanks that are in compliance with the rule and have the need to have preventative maintenance or have stock removed to do so without violating the rule. If a tank is non-compliance, the work being performed would not be considered preventative maintenance. This exemption is justified because short-term

emissions resulting from doing preventative maintenance outweigh the potential long-term emissions from non-compliance.

The proposed amendment to Section 8-5-111.2 will require written notice from the owner or operator that the tank is in compliance prior to notification.

The proposed amendment to Section 8-5-111.5 will require that tank emissions be minimized during the period of exemption. The liquid product in the tank must be drained to the extent possible before any hatches are opened. Tank degassing equipment and the associated emission control system must be connected and operating as soon as possible.

#### *8-5-112 Limited Exemption, Tanks in Operation*

This section is for tanks that are in compliance and have the need to perform preventative maintenance on a vapor control device, repair a roof, conduct a primary seal inspection, or remove and install a secondary seal. If the tank were out of compliance, the work being performed would not be considered preventative maintenance and the operator cannot apply for this exemption.

#### *8-5-214 Gauge Float*

This proposed new definition of a device to indicate the liquid level inside a tank is related to the slotted guide pole requirement.

#### *8-5-215 Guide Pole*

This is a proposed new definition. The guide pole is an anti-rotation device that is fixed to the top and bottom of a tank, passing through an opening in a floating roof.

#### *8-5-216 Zero Gap Pole Wiper Seal*

This is a proposed new definition. The zero gap pole wiper seal is a device that may be retrofitted onto a slotted guide pole to reduce emissions. The “zero gap” part of the definition is defined as a maximum gap of 0.06 inch between the wiper and guide pole.

#### *8-5-320.5 Tank Fitting Requirements (Slotted Guide Poles)*

Gaskets, wiper seals, and pole sleeves will be required for all slotted guidepoles by June 1, 2000. Retrofit kits are readily available which significantly reduce emissions and can be installed without taking the tank out of service.

#### *8-5-321.2 Metallic-shoe-type seals (existing internal floating roof tanks)*

This is to clarify a requirement in the federal New Source Performance Standards for metallic-shoe type seals used only on external floating roof tanks to meet a minimum vertical distance above the liquid surface of 24 inches. A separate criteria is needed for

existing internal floating roof tanks. Staff is proposing a requirement for metallic-shoe-type seals used on existing internal floating roof tanks to meet a minimum vertical distance of 18 inches.

## **Phase II: Proposals under Review**

Proposal amendments to Regulation 8-5 will be presented in two separate rule packages to allow the District to meet its December 31, 1999 Ozone Attainment Plan deadline and to thoroughly address the concerns raised at the workshop. The following list of changes that will be brought back at a later date:

- Require some organic liquids presently stored in higher emitting fixed roof tanks to be stored in floating roof tanks or to be controlled by vapor collection system.
- Require that tank roof seals be upgraded when replaced with high quality seals based on emission control effectiveness and longevity of service.
- Require more frequent inspections of floating roof tank seals.
- Require fittings on external and internal floating roof tanks and fixed roof tanks connected to vapor recovery to meet certain leak tight criteria to minimize emissions.
- Require improvements and modification to gas-blanketed tanks.
- Add new definitions and improve compliance requirements.

## **Emission Reductions**

### **Slotted and unslotted guide poles**

The following emission-control test data performed by Chicago Bridge and Iron Technical Services for the API Publication 2517 (1989) and its addendum. The average emission reduction from external floating roof tanks is estimated to be 3200 lb of organic vapors per year per affected tank, based on a 10 mile per hour wind and storage of gasoline or high vapor pressure crude oils. The results of five of these tests are summarized as follows:

CBI Test	Well Gasket	Float with	Pole Sleeve	Loss-factor @	% Reduction
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Fitting #	and Pole Wiper	Wiper		10 miles/hr	
				(lb-mole/yr)	
1	None	None	None	6620	Baseline
20	Yes	None	None	2250	66%
23	Yes	Yes	None	700	80.3%
32	Yes	None	Yes	379	94.2%
29	Yes	Yes	Yes	53	99.2%

Based on the number of external floating roofs with slotted guide poles in the San Francisco Bay Area and accounting for the variable vapor pressure of organic liquids, the total reduction resulting from the proposed amendments to Regulation 8, Rule 5, is 320 tons per year or 0.87 tons per day of reactive organic compounds. An American Petroleum Institute (API) document from March 30, 1994 indicates that actual emissions (and therefore reductions from implementation of controls) are significantly higher than earlier District estimates of 0.49 ton per year. Detailed calculations are attached as Appendix A.

## Economic Impacts

The total cost of retrofitting affected organic liquid storage tanks with appropriate equipment to minimize emissions from slotted guidepoles is estimated to cost a total of \$400,000. This is a one-time cost. There are no on-going maintenance costs associated with the proposed amendments. The cost effectiveness is \$1250 per ton of organic emission reduced.

Component	Emission Reduction (tons/yr.)	Annual Cost	Cost Effectiveness (\$/ton)
Slotted Guide pole-sleeve & wiper	320	\$400,000 (only one time cost)	\$1250

The emission reduction estimates are based on 200 external floating roof tanks with slotted guide poles. The number of facilities that are affected are six petroleum refineries (including one topping plant) and 16 gasoline/chemical bulk storage terminals.

## Socioeconomic Impacts

An assessment of the socioeconomic impacts of proposed amendments to Regulation 8, Rule 5 was prepared pursuant to Section 40728.5 of the Health and Safety Code. This analysis was conducted by Applied Development Economics, Inc. (ADE) and based on cost information provided to ADE by the District. The socioeconomic analysis, attached as Appendix B, includes the proposed Phase II revisions to the rule. The analysis concludes that, including the measures for Phase II, there would not be a significant socioeconomic impact to the petroleum refining, bulk gasoline terminalling or chemical manufacturing industries in the Bay Area.

## **Incremental Costs Effectiveness of Potential Control Options**

Health and safety code Section 40920.6 requires the District to (1) identify one or more control options achieving the emission reduction objectives for the proposed revision, (2) determine the cost effectiveness for each option, and (3) calculate the incremental cost effectiveness for each option. To determine incremental cost effectiveness, the District must “calculate the difference in the dollar costs divided by the difference in the emission reduction potentials between each progressively more potential control options as compared to the next less expensive control option.” Where only one control option is identified, no incremental cost analysis can be performed.

There is only one control option identified for control of emissions from slotted guide poles. This report, therefore, does not include an incremental cost analysis.

## **Environmental Impacts**

The proposed rule amendments will have overall positive environmental impacts on air quality. In addition to reduction in ozone forming organic compounds, this rule will reduce odorous emissions and reduce exposure of nearby residents to toxic air contaminants.

Based on the entire record before the Staff on this rulemaking project, Staff has not identified any substantial evidence of adverse environmental impacts. A complete discussion is attached as Appendix C, California Environmental Quality Act (CEQA) initial study and negative declaration.

## **Regulatory Impacts**

Section 40727.2 of the California Health and Safety Code requires the District to identify existing federal and District air pollution control requirements for the equipment or source type affected by the proposed rule. The District must then note any differences between these existing requirements and the requirements imposed by the proposed change.

The standards for slotted guidepoles being proposed are identical to the requirements found in the federal New Source Performance Standard (NSPS) for new, large organic liquid storage tanks. Those tanks that have already complied with the federal standard will incur no costs to comply with this proposal. 120 tanks in the District, about 38% of

all the existing external floating roof tanks, already comply. District Best Available Control Technology (BACT) for external floating roof tanks would require the best available rim seals, but the requirements for slotted guidepoles are identical. The effect of the proposed amendments is to bring all tanks with slotted guidepoles up to the standard of the NSPS and BACT requirements.

## **Rule Development History**

This rule amendment is derived from a portion of Control Measure B2 as originally proposed in the District's 1997 Clean Air Plan for the California one-hour ozone standard. In the course of development of the 1997 Clean Air Plan, and subsequently, of the 1999 Ozone Attainment Plan for the one-hour federal ozone standard, the proposed requirement to retrofit slotted guidepoles with equipment to minimize fugitive organic emissions. The slotted guide pole issue was discussed at public workshops related to the control measures in the federal Ozone Attainment Plan. On September 23, 1999, a public workshop to discuss this, and other proposals identified as "Phase II" proposals were discussed. There were no adverse comments received regarding the proposed slotted guidepole requirements that constitute the present amendment to Regulation 8, Rule 5.

Due to a commitment to adopt control measure by December 31, 1999 in the 1999 Ozone Attainment Plan, the amendments regarding slotted guidepole requirements are being proposed at this time. Staff intends to rework the other proposals contained in the initial draft, hold another workshop to further discuss issues raised on September 23, and return to the Board in the near future with further amendments to Regulation 8, Rule 5. Staff anticipates that the additional amendments will result in emission reductions of about 8 tons per day.

## **District Staff Impacts**

District staff is not expected to be impacted by this proposal. The staff already has dedicated inspection staff for petroleum refineries. Each of these facilities, as well as gasoline bulk terminals and chemical plants, may already have to comply with existing federal New Source Performance Standards, so enforcement personnel are already aware of the proposed standards. By incorporation of these federal standards in to this rule that affects all storage tanks, these amendments will merely make uniform the enforcement of these standards. These amendments will not affect the permitting of organic liquid storage tanks.

## **Comments and Responses**

To date, three comment letters regarding this proposal have been received. All three letters support the need to promulgate the slotted guide pole control portion by December 31, 1999 and recommends that the separation of the amendments into two phases. One

letter recommends that the Board of Directors set a deadline for consideration for adoption of the second phase of amendments by October 31, 2000.

## **Conclusions and Findings**

The proposed amendments to Regulation 8, Rule 5 are expected to reduce organic emissions by 0.87 tons per day. The proposals fulfill the commitments made in the District's 1999 Ozone Attainment Plan and are an important component of the strategy to sufficiently reduce emissions to re-attain the one-hour federal ozone standard by June 1, 2000. The proposal is cost effective and there are no associated adverse environmental impacts. The proposal has been discussed with interested and affected parties both as part of the plan and at a public workshop related to proposed changes to this rule on September 23, 1999.

Pursuant to Section 40727 of the California Health and Safety Code, the proposed rule must meet findings of necessity, authority, clarity, consistency, non-duplication, and reference. The proposed amendments to Regulation 8, Rule 5 are:

- Necessary to limit emissions of volatile organic compounds from over 5000 organic liquid storage tanks in the San Francisco Bay Area, a primary precursor to ground-level ozone formation, and to meet the requirements of the 1999 San Francisco Bay Area Ozone Attainment Plan specifically Control Measure SS-07;
- Authorized under Sections 40000, 40001, 40702, and 40725 through 40728 of the California Health and Safety Code;
- Written or displayed so that its meaning can be easily understood by the persons directly affected by it;
- Consistent with other District rules, and not in conflict with state or federal law;
- Non-duplicative of other statutes, rules or regulations; and
- Implementing, interpreting or making specific the provisions of the California Health and Safety Code Sections 40000 and 40702.

The proposed new rule has met all legal noticing requirements, has been discussed with the regulated community, and it reflects the input and comments of many affected and interested parties. District staff recommends adoption of proposed amendments to Regulation 8, Rule 5: Storage of Organic Liquids.

## **References**

Bay Area '97 Clean Air Plan, Volume I, II, and III, Bay Area Air Quality Management District, December 17, 1997

Bay Area Air Quality Management District Staff Report, Regulation 8, Rule 5, November 16, 1992

Rule 463 and Staff Report, Storage of Organic Liquids, South Coast Air Quality Management District, January 11, 1994.

Petroleum Refining- Crude Oil- Petroleum Products Process Flowsheets, edited by Jean-Pierre Wauquier, Institut Francais du Petrole, 1995

Manual of Petroleum Measurement Standards, Chapter 19, Evaporative Loss Measurement, Section 2, and Evaporative Loss from Floating Roof Tanks, API, April 1997

API Briefing paper, March 30, 1994 on new slotted guide pole emission factors, API, 1220 L Street, Northwest, Washington, D.C. 2005

Control of Volatile Organic Emissions Form Petroleum Liquid Storage in External Floating Roof Tanks, EPA-450/2-78-047 OAQPS No. 1.2-116, December 1978.

Petrochemical Evaporation Loss from Storage Tanks, American Petroleum Institute, API Bulletin 2523, November 1969.

Hydrocarbon Emissions from Refineries, American Petroleum Institute, API Bulletin No. 928, July 1973.

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Evaporation Loss from External- Floating Roof Tanks, American Petroleum Institute, API Publication no. 2517, February, 1989

Evaporative Loss from Fixed-Roof Tanks, API Publication 2518, second Edition, October 1991.

Evaporation Loss from Internal-Floating Roof Tanks, American Petroleum Institute, API Publication No. 2519, June, 1983

Evaporative Loss from External Floating-Roof Tanks, Laverman, R.J., presented at American Pipeline Institute 1989 Pipeline Conference, Dallas, Texas, April 17, 1989.

VOC Emissions from Volatile Organic Liquid Storage Tanks- Background Information for Proposed Standards, EPA 450/3-81-003a, July 1984.

Welded Steel Tanks for Oil Storage, API Standard 650, Eighth Edition, November 1988.

Venting Atmospheric and Low-Pressure Storage Tanks, API Standard 2000, Third Edition, January 1982.

Specification for Bolted Tanks for Storage of Production Liquids, API Specification 12B, October 1990.

## Appendix A

Information obtained from District databank, December, 1998

<b>External Floating Roof Diameter, ft</b>	<b>number of tanks</b>
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Less than 50	33
50-100	64
100-150	154
150-200	39
200-250	25
greater than 250	7

<b>Internal Floating Roof</b>	<b>number of tanks</b>
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Less than 50	81
50-100	80
100-150	32
150-200	5
greater than 200	

<b>Fixed Roof</b>	<b>number of tanks</b>
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≥300	1
≥299-250	7
≥200-249	26
≥150-200	41
≥100-150	157
≥50-100	69
less than 50	3900

District Databank shows 128 EFRTs and IFRTs must meet zero gap requirements

**\*Table 6 Deck-Fitting Loss Factors,  $K_{fa}$ ,  $K_{fb}$ , and  $m$ , Typical number of Deck Fittings,  $N_f$ ; and Deck-Fitting Loss Factors,  $K_f$ , at Selected Average Wind speeds**

Guidepoles

**Unslotted (Unperforated) Guidepoles**

Deck-Fitting Loss Factor,  $K_f$

{ (lb-mole/yr.) }

Well Gasket (Yes/no)	Float w/wiper (Yes/no)	Pole Wiper (Yes/no)	Pole Sleeve (Yes/no)	0 (mph)	5 (mph)	10 (mph)	15 (mph)
NO	NO	NO	NO	31	900	2300	4100
Yes	NO	NO	NO	25	230	970	2300
NO	NO	NO	Yes	25	56	160	330
Yes	NO	NO	Yes	9	42	67	89
Yes	Yes	Yes	NO	14	24	31	37

**Slotted (perforated) Guidepoles**

Deck-Fitting Loss Factor,  $K_f$

{ (lb-mole/yr.) }

Well Gasket (Yes/no)	Float w/wiper (Yes/no)	Pole Wiper (Yes/no)	Pole Sleeve (Yes/no)	0 (mph)	5 (mph)	10 (mph)	15 (mph)
Yes or NO <sup>a</sup>	NO	NO	NO	43	1600	4200	7300
Yes or NO <sup>a</sup>	Yes	NO	NO	31	470	1800	400
Yes	NO	Yes	NO	41	320	770	1300
Yes	NO	NO	Yes	11	280	710	1200
Yes	Yes	Yes	NO	21	100	280	570
Yes	NO	Yes	Yes	8	41	110	200
Yes	Yes	Yes	Yes	11	41	67	91

<sup>a</sup> limited data not support differentiation for the presence or absence of well gaskets for these construction details

\*Excerpt from Manual of Petroleum Measurement Standards-Chapter 19-Evaporative Loss Measurement, April 1997.

More detailed in Table 6 of Manual of Petroleum measurement Standards-Chapter-Evaporative Loss Measurement

### Slotted Guide Poles

$$\underline{1800 \text{ lb-moles/yr.}} = 4.932 \text{ lb-moles/day}$$

365 days/yr.

$$\underline{710 \text{ lb-moles/yr.}} = 1.95 \text{ lb-moles/day}$$

365 days/yr.

$$\underline{280 \text{ lb-moles /yr.}} = 0.77 \text{ lb-moles/day}$$

365 days/yr.

$$\underline{110 \text{ lb-moles /yr.}} = 0.31 \text{ lb-moles/day}$$

365 days/yr.

50 tanks  $(4.9 - 0.3) \times 0.079$  (4.0 psia)  $\times 64$  LB/lb-moles = 1162.88 lb/day (some tanks have higher v.p. materials)

100 tanks  $(4.9 - 0.3) \times 0.037$  (2.0 psia)  $\times 50$  lb/lb-moles  $\times 0.4$  (for crude oil) = 340.4 lb/day

50 tanks  $(4.9 - 0.3) \times 0.017$  (1.0 psia)  $\times 64$  lb-moles = 250.24 lb/day

$1162.9 + 340.4 + 250.2 = 1753$  lb/day of hydrocarbons from 200 external floating roof tanks

The cost of a pole sleeve is estimated to be between \$800\* and \$1200\* (average \$1000) and installation cost is estimated to be approximately \$1000\*, for a total cost of \$2000.

$$\$2000 \times 200 \text{ pole sleeves} = \$400,000$$

$$1753 \text{ lb/day} \times 365 \text{ days/yr} = 639,845 \text{ lb/yr. -}$$

$$320 \text{ tons/yr.}$$

$$\$400,000/320\text{tons /yr.} = \$1250 \text{ per ton of emission reduction}$$

\*Based on phones conversations between District staff personnel and tank builders.